TESTIMONY
OF
C. RENEE COOPER

On Behalf of
the Perry Institute of Marine Science and
The Caribbean Marine Research Center

June 30, 1999

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Madam Chairwoman, as President of the Caribbean Marine Research Center I am pleased to appear before you today on behalf of the Perry Institute of Marine Science and the Caribbean Marine Research Center to strongly endorse this Subcommittee=s commitment to coral reef conservation.

The Caribbean Marine Research Center (ACMRC@), one of the six regional centers participating in the National Undersea Research Program, has a thirty year history of accomplishment in coral reef research and conservation. CMRC operates the largest field station and marine laboratory in the southeast United States, Gulf Coast and Caribbean region. Its research facilities are one of the premier sites for coral reef research in the world.

Researchers from approximately 120 U.S. universities and research institutions have conducted research projects at CMRC=s research facilities. More than 150 scientists have come to CMRC=s research facilities to undertake coral reef research. Based on their research at CMRC=s facilities, these scientists have published 155 scientific papers on coral reef conservation and restoration.

Recent coral reef projects conducted at CMRC=s research facilities or sponsored by CMRC include research on (1) how to rebuild injured coral reefs by applying biotechnology to reseed damaged reefs; (2) methodologies to assess the health of coral reefs and other reef organisms; (3) the effect of oceanographic conditions on nutrient transport and the health of coral reefs; (4) the optimal light and temperature conditions needed for coral reef growth; (5) the impact of global warming on coral reefs, including the impact of ultraviolet radiation on tropical reefs; (6) the impact of various pollutants on coral reefs; (7) the effects of increased water turbidity on coral reef survival; (8) the range of natural variation in coral reef health and ecosystem structure; (9) methodologies for identifying and monitoring the incidence of coral disease; (10) larval production and metamorphosis in coral reefs; (11) the physiology of coral reefs; (12) the impact of hurricanes on reefs; (13) the community structure of reef corals; and (14) the phenomena of coral bleaching and recovery.

The previous Director of the National Undersea Research Program characterized CMRC=s coral reef program as providing Aan invaluable service not only to the scientific community, but also to U.S. resource managers@ because the research conducted at CMRC=s facilities Ais absolutely required to help in the preservation and restoration of the U.S. [Exclusive Economic Zone] coral reefs.Y Without the responsive nature of CMRC=s coral reef studies, it would be difficult to determine how to proceed to save severely damaged corals.@

Although CRMC also conducts extensive research relating to global warming, fish ecology and fisheries conservation, aquaculture, deep sea dynamics, alternative energy sources, physical oceanography, and biotechnology, it is our expertise and experience in coral reef conservation and restoration which brings us before you today.

CRMC strongly endorses the efforts being made by this Committee=s leadership to establish a coral reef conservation program. The importance of such legislation cannot be understated. Existing coral reef programs focus primarily on reef assessment and monitoring techniques. It is important to take the next step which is to develop, verify, and implement coral reef conservation methods and restoration technologies.

More than 60% of the world=s coral reefs are threatened by human activities including intense coastal development, overfishing and pollution. Coral reefs fulfill many vital needs of the United States including: providing major commercial and sport fisheries with habitats essential to their survival during one or more life stages, supplying the prey that the major species of fish feed upon since reefs are the primary habitat of many of the prey species,
protecting our coastal communities from major storm damage, attracting tourists and supporting the coastal tourist economy in the tropics and subtropics, and providing vitally important biotechnology and genetic material for use in medicines and cancer-arresting drugs and for use as surgical implants in bone reconstruction.

Coral reefs are estimated to be worth $375 billion annually by providing fish, medicines, tourism revenues, and coastal protection for more than 100 countries. As the most productive areas in the ocean, coastal environments that include coral reefs as a major component account for 38% of the goods and services provided by the earth=s ecosystems. This magnitude of productivity equates to over $12.5 trillion per year, slightly more than that from terrestrial systems.

Coral reefs support major ocean fisheries such as spiny lobster, grouper, snapper, Jack, Ballyhoo, mackerel and dolphin fish. Coral reefs provide the engine to support the world=s fisheries because coral reef environments provide vital links in the food chain and the critical habitat that major commercial and sport fish species depend on for survival during one or more parts of their life cycle. And the importance of protecting our fisheries cannot be underestimated. Worldwide, people obtain approximately 16% of their animal protein from fish --- and the demand for seafood is expected to increase by 70% in the next 35 years. Over 200 million people worldwide depend on fishing for some portion of their income. A significant portion of the multi-billion dollar value of international fisheries comes from fisheries associated with and supported by coral reefs.

An invaluable wealth of medicines and genetic material are waiting to be discovered in the life forms that inhabit coral reef environments. For example, as recently as 1997, scientists discovered that a fish inhabiting reef environments produces a compound that arrests cancer by stopping the blood flow to tumors.[1] CMRC has supported vital biotechnology research on the newly discovered active compound in a Caribbean soft coral used in skin treatments. This discovery, along with the development of sustainable harvest techniques, culture techniques, basic biology and essential habitat information is expected to lead to a new and economically important biotechnology industry which holds the promise of new treatments and cures.

Over 30 drugs from the oceans, many of which are from coral reef environments, are under investigation by drug companies. Compounds have been developed which can be used to sooth swelling caused by sunburn or chemical irritants by blocking a key enzyme involved in inflammation. Psoriasis, sunburn and arthritis all involve inflammation that one day may be treated by an agent found in the soft coral. The same extract could potentially have many medicinal uses. For example, the extract might be added to toothpaste for soothing inflamed gums, or to skin creams to limit sun damage.

The results of biotechnology discoveries in reef environments also have application in reef restoration. For example, CMRC is sponsoring research that unlocks the mystery of coral colonization. The new technology will provide a vital solution to the world=s declining reef communities by inducing coral reef rejuvenation and restoration.

This new research, sponsored by CMRC, the National Undersea Research Program, and the National Science Foundation, offers the prospect of responding to the distressing trends in coral decline with a practical, universal solution. This revolutionary solution focuses on the development of a Acoral flypaper@ B a chemically treated surface designed to induce coral larvae to settle from the plankton and metamorphose into baby corals. The larvae of corals must first detect a chemical signal in their ocean environment before they can settle from the plankton, attach to a hard surface and develop into mature corals. The newly discovered signal molecule required by coral larvae is attached to materials such as glass or tile. The result is Acoral flypaper@ to cue coral larvae to settle from the water, attach to its surface and develop into thriving corals.

It is a distressing fact that we need such restoration programs because coral reefs and the marine resources that depend on them are severely threatened throughout the world. Direct and indirect human activities that cause stress, deterioration and death to coral reef ecosystems have increased significantly over the last several decades. Approximately 60% of the world=s coral reefs are currently threatened and 10% of the world=s reefs are severely damaged or destroyed. Although many coral reefs can recover to a healthy state if stresses are removed or reduced through conservation efforts, the facts are that restoration programs are essential.

The conditions that make coastal areas the prime site of coral reef growth B shallow water and their place at the crossroads between land and seas B unfortunately also make them vulnerable to human assault. Currently more than 2 billion people live in coastal areas and many more millions crowd the world=s beaches and coastal areas each year. Human activities increasingly cause much of the decline in coral reefs. Coral reefs in the southeastern United States and the wider Caribbean region, indeed, reefs throughout the world, are currently under siege by various threats.

The most accessible coastal environments are becoming heavily impacted due to the sheer numbers of

[1] Other examples of anti-cancer drug discoveries from ocean resources include the following: a chemical found in an Indian Ocean mollusk shows promise as a skin cancer cure; a Caribbean sea whip produces a compound that has been effective against leukemias and human breast cancer; agents found in Australian yellow soft coral and a Mediterranean coral stop malignant tumors from growing; and a New Zealand yellow sponge produces a promising anticancer chemical.

visitors. Damage is done to fragile reef areas by careless snorkelers and divers, anchor impacts, accidental boat groundings and propeller damage. But, coastal deforestation, coastal development, and beach renourishment projects are also significant forces impacting coral reefs. Such activities often cause sediment runoff which clouds nearshore waters and smothers corals that need sunlight to survive. Contaminants such as fertilizers, human wastes, toxic chemicals and sediment also come from land-based pathways, flowing down rivers into tidal estuaries where these contaminants bleed into the reef environments. Some of these contaminants promote algal blooms that rob the oxygen content of coastal waters, choking the life out of fish, corals and countless other marine creatures. Large portions of the Gulf of Mexico are now considered ecological Adead zones@ due to algal blooms.

The introduction of exotic species, those species transplanted from their place of origin by human actions, represents another threat to the world=s coral reefs. Globally, thousands of exotic species are estimated to be in the ballast tanks of ships that cruise from one country to another. The waters of the United States are thought to receive at least 56 million tons of discarded ballast water a year. Heavily stressed marine environments are more susceptible to rapidly colonizing species. For example, the Black Sea was vulnerable in the 1980=s to an exotic species introduction due to a combination of overfishing, coastal habitat degradation, and increasing agricultural and industrial pollution. With no natural enemies and a diet of fish eggs, larvae and other plankton, the Atlantic comb jelly B probably released from a ship=s ballast B helped wipe out 85% of the marine species in the Black Sea. Today, the coral reef environments of the Florida Keys, Gulf of Mexico and wider Caribbean are equally vulnerable to exotic species due to heavy ship traffic in the region.

Changes in temperature, climate and atmospheric conditions pose high risks to marine species living in and comprising coral reef environments. CMRC has been monitoring these changes and their effects on coral and other reef organisms for two decades. Data have shown increases in ultraviolet radiation caused by a decrease in the protective ozone layer of the atmosphere. Studies on the resulting effects shows that the increase in radiation has a negative effect on photosynthesis and, therefore, on the base of the food chain in the oceans and on primary food production in reef environments. Research has also shown that the increased radiation damages larval development in corals, shrimp, crabs, and some fish. These effects could devastate coral reefs and some fisheries. Other potential devastation resulting from climate change includes increasing ocean temperatures that scientific research has linked to the severity in coral bleaching. Researchers at CMRC have studied natural variation in coral pigmentation and the factors contributing to coral bleaching since the mid-1980=s when wide-spread coral death resulted from a major bleaching event. Further study is needed to identify coral reef areas with the highest risk of bleaching induced death and to discovery ways of mitigating those threats. Passage of the pending legislation will help make that important work possible.

We appreciate that you share our concern about the preservation of healthy coral reef environments and about the urgent need to develop conservation and restoration methods for coral reefs. We have a chance to protect our important coral reef resources through sound scientific methods and the development of viable management approaches.

CMRC believes enactment of S.725 would be a significant step forward in the conservation and restoration of coral reefs. We would, however, suggest a few minor amendments to S.725. The text of these amendments is enclosed as Attachment A to my testimony. CMRC believes these amendments would strengthen S.725 which provides for a vitally important next step in the fight to save the viability of our coral reefs. Current funding and agency support is focused on assessment, monitoring and enforcement in coral reef areas. The provisions of S. 725 directly support the verification, demonstration and implementation of coral reef conservation and restoration technologies. This legislation provides marine resource managers responding to our nation=s urgent plea for action with real solutions and the funding with which to implement them.

I would also like to apologize to Senator Inouye because we did not have the time before this testimony was required to be submitted to carefully examine S.1253, principally because I was serving on jury duty last week. However, we would be pleased to offer suggested amendments to that bill if that would be helpful to you.

Madam Chairwoman, I commend you and Senator McCain for your leadership in establishing a national coral reef conservation program. I also commend Senator Inouye and several Members on the other side of the aisle who are equally interested in this issue and are fully committed to establishing a national coral reef conservation program. My sincere hope is that this Committee will move forward to enact a coral reef conservation program which will propel this nation into an international leadership position on coral reef

conservation and management. We also recognize that in this era of budgetary limitations there is substantial difficulty in starting new programs and that our expectations and goals must be realistic. Nevertheless, CMRC is prepared to work with, and to support, this Committee=s initiative in every way possible. Coral reefs in the United States and throughout the world provide enormous benefits to our society and merit the full attention of this Congress and of this country.

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PROPOSED AMENDMENTS TO S.725

1. Page 1, after line 11, insert the following and renumber subsequent paragraphs accordingly:

"(3) To verify and demonstrate coral reef conservation and restoration technologies and methodologies;

"(4) To assist in the conservation, protection and restoration of coral reefs by developing standard conservation and restoration criteria and guidelines;".

2. Page 4, line 14, after the period insert the following:

"Such projects shall be consistent with standardized conservation and restoration criteria and guidelines developed by the Secretary or developed pursuant to projects approved under this Act.".

3. Page 3, line 19 after the second semi-colon, insert the following:

"the development of standardized conservation and restoration criteria and guidelines for coral reef resource managers; verifying and optimizing coral reef protection and restoration methodologies and technologies; the development of sound scientific methods for determining the condition of coral reef ecosystems and for identifying and categorizing the threats to such ecosystems;".

4. Page 9, amend lines 9-11 to read as follows and renumber subsequent paragraphs accordingly:

"(4) verifying and optimizing conservation and restoration methodologies, technologies and procedures through research and demonstration;

"(5) developing standardized conservation and restoration criteria for coral reef resource managers;

"(6) developing sound scientific methods for determining the condition of coral reef ecosystems, identifying and categorizing the threats to such ecosystems and selecting optimum mitigation and restoration actions based on the specific circumstances of such ecosystems;

"(7) developing decisionmaking processes and guidelines for coral reef resource managers;".

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